The roots of Marsilia were hardened with chromic acid and stained on the slide with gentian violet. The methods employed with Equisetum gave good results in this case also. The sections were made with a Minot microtome and ran 1800 to the inch.

EXPLANATION OF FIGURES 1 AND 2.—Drawn with a Zeiss camera. Fig. 1, longitudinal section of root-tip of Marsilia quadrifolia ×300. Fig. 2, same of Equisetum arvense ×187. In both figures the reference letters are as follows: *a*, apical cell; II, III, V, VI, etc., segments of body of root; *P*, periblem; *p*, initial cells of periblem; *P C*, plerome cylinder; *p c*, initial cells of plerome cylinder; *E*, dermatogen; *h*, hypodermal layer; $r^{i}$, $r^{ii}$, $r^{iii}$, $r^{iv}$, $r^{v}$, successive segments of root-cap; *d*, endodermis.

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## BRIEFER ARTICLES.

**Origin of the honey-secreting organs.**—A few sentences from Stadler's work "Zur Kenntniss der Nectarien"[1] seem to me to throw some light on the probable origin of the honey-secreting organs of flowers.

He says (I give free translations): "The vessels which are always present, if not in the tissue of the nectary itself, then in its substratum, are usually very strongly developed, terminating in the border of the gland tissue; indeed their more delicate elements, the cambiform, penetrate it."[2]

Also: "The nectaries not only satisfy the demand of insects for honey, but also account for the loss of water through evaporation, which is always considerable."[3]

And again: "In the vicinity of the nectary I found almost without exception some chlorophyll-bearing tissue. Even in regions where, because of other conditions, one would not expect it; as in Lilium auratum under the nectary between the two vascular strands; in the hood and in the anther-column of Asclepias Cornuti, etc. These chlorophyll tissues may by themselves alone, or together with others further away, be the laboratories for the manufacture of the carbo-hydrates which the nectaries need; they may, under no circumstances, give them to the nectary in a form directly capable of secretion."

The first of these statements is not surprising. In order to supply stamens and ovaries with the food materials so abundantly stored in pollen grains and ovules, there should be a strong current of water continu-

[1] "Beiträge zur Kenntniss der Nectarien und Biologie der Blüthen" von Dr. Stadler. Berlin, 1886.

[2] P. 69.

[3] P. 70.

ally bringing to them the crude materials from which starch, fats, proteids, etc., are made. Hence the necessity for a well developed vascular system in connection with the floral organs. For it is well known that water travels through wood vessels, and Haberlandt (among others) has shown[4] that there is a close parallel between the water conducting power of a tissue and the number of its vessels and tracheids.

But a current of water implies evaporation. Otherwise there could be no current, only stagnation. Moreover a large proportion of the water in which these dissolved substances are carried is not itself needed for growth (at least not after the flowers have expanded) or for food manufacture. It must be gotten rid of that more water containing needed working materials may take its place. The rapid withering of cut flowers is the logical result of this process and the proof of evaporation. Microscopic examination shows, too, that in addition to the commonly delicate character of the floral organs (and envelopes in many cases), this transpiration is often aided here, as from leaf surfaces, by the presence of stomata. Stadler finds the secretion of honey through stomata to be the "commonest case."[5] The fact, too, noticed by Müller and others, that honey is secreted only under certain conditions of temperature and sunlight, points to the conclusion that it is of the nature of, or stands in close relation to, evaporation.

It is a well known fact that some plants, which grow in soil containing much lime, have upon their leaves deposits of calcium which, carried in solution through the plant, have been left behind when the water was evaporated; *e. g.*, species of saxifrage.

Finally we have to notice the immediate connection with the nectary on the one hand, and with the vascular tissue on the other, of chlorophyll bearing cells, *i. e.*, of cells in which the crude materials brought by the water through the vessels may be united with carbon to form starch, with which, again, other organic compounds may be produced. These substances travel by osmosis from cell to cell until they reach the stomata, if there are any, or the subepidermal-layer of cells from which water is continually being drawn by vigorous surface evaporation. As the lime-laden water of saxifrage takes some of its burden to the very end of its course, leaving it only when the force of vaporization pulls them apart, so there seems nothing improbable in the supposition that water heavily (of course, only comparatively speaking) charged with sugar, the traveling form of starch, should carry some of that with it until it is itself vaporized, leaving it there as a saccharine deposit.

Stadler finds that in nearly one-half of the cases observed the glucose arises from the transformation of starch; in a few cases from fatty oils (Cydonia, Impatiens); in others from tannin, which is easily converted into starch, as starch is into tannin again (pages 71 and 72). All of these

[4] G. Haberlandt, Physiol-Anatomie, p. 213.
[5] Beitrage zur Kenntniss der Nectarien, p. 73.

substances are common in living cells, their transformation into the diffusible form of glucose is the phenomenon common to osmosis currents throughout the plant.

Perhaps here is a partial explanation of the presence in flowers of the materials upon which natural selection has worked in the production of honey: a large supply of water bringing to cells comparatively near the surface substances in solution which are there united into diffusible organic compounds, and rapid evaporation of this water which carries with it to the surface a small part of these materials dissolved in it. That the first secretions of this kind may not have been perceptibly sweet is suggested by the occurrence of nectar like that of Pinguicula, which is mere "slime," and by the fact that the nectar of different kinds of flowers varies greatly in degree, as in quality, of sweetness. The earliest nectaries were also probably unspecialized in form, mere surfaces from which evaporation went on from cells rich in pollen or seed-producing substance lying directly over a network of vascular tissue. Perhaps the watery secretion found the first day of blossoming, in the stigmatic cavity of Nymphæa tuberosa, represents such a primitive form. The development of greater sweetness, of peculiar form, of protective coverings (spurs, hairs, etc.), the localization of the secreting power in particular spots, etc., must be delegated to the working of natural selection—here, largely, insect selection—to which also the peculiar forms of the other parts of many flowers are generally admitted to be due.—ALICE CARTER, *Mt. Holyoke College, South Hadley, Mass.*

**Peronospora Rubi Rabenh. in America.**—Last year, after the GAZETTE'S notice of the discovery of *Peronospora Cubensis* B. & C., here at New Brunswick, it was found in at least two other localities in the United States. A similar note to the effect that on May 26th the *Peronospora Rubi* Rabenh. was discovered upon Rubus strigosus may lead observers to look for this species elsewhere. I do not find any record of this mildew having previously been seen upon living hosts in this country. As it was taken upon cultivated raspberries it becomes of interest to growers of this fruit, as it is very likely it will spread to other cultivated species of the genus, for its two hosts in Germany are R. cæsius and R. fruticosus.—BYRON D. HALSTED, *New Brunswick, N. J.*

**Cynosurus cristatus L.**—I have noticed, lately, the "crested dog's-tail grass" (Cynosurus cristatus) growing abundantly in the small grass plots, in Boston, before many of the houses. It also occurs in Cambridge in similar situations. I inquired at one of the large seed stores in Boston, and was informed that it was mixed with other grass seeds and sold for use on lawns and the like. The species is a native of Europe and Northern Africa, and as its roots sink deep into the ground it can withstand droughts much better than many other grasses.—WALTER DEANE, *Cambridge, Mass.*